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"DOUBLE-CUT" TAPPING SYSTEMS IN CEYLON

R. K. S. MURRAY, A.R.C.S.,
MYCOLOGIST, RUBBER RESEARCH SCHEME (CEYLON)

FOREWORD

DURING the past two or three years a number of Ceylon estates have adopted "double-cut" tapping systems whereby the trees are tapped on two half-spiral cuts on opposite panels, either every three days with a periodic rest ("Double-Three" or "Sunderland" system), or every four days without a resting period ("Double-Four" or "Healey" system). Introduced at a time of acute depression with a view to effecting an economy in the cost of tapping, these systems have proved so satisfactory on some estates that their mentors regard them as permanent successors to the normal system of alternate day tapping on one half-spiral cut. In the absence of data from field experiments of any considerable duration the Rubber Research Scheme, in reply to numerous enquiries, has adopted an attitude of cautious approval. The opinion has been expressed that in most districts either system may safely and advantageously be adopted under present economic conditions in order to reduce tapping costs, but that it is yet too early to say whether they are likely to prove suitable for permanent adoption.

In order to obtain as much information as possible from estates which have adopted one or other of these tapping systems a questionnaire was circulated in March, 1933, to all Proprietors and Superintendents who have registered for the receipt of Research Scheme publications. The response to this questionnaire was very satisfactory, and we are indebted to Proprietors and Superintendents for a considerable mass of valuable information, observations and opinions. The conclusions expressed in this report are based partly on these replies and partly on observations made by officers of the Research Scheme. A strict analysis of the replies is not presented; this would not be of any great value and might, indeed, be somewhat misleading since equal weight cannot be given to observations based on long experience and those made after only a few months' trial.

An analysis shows that on the great majority of estates on which the double-cut systems are employed their adoption only dates back to 1932. Most of the results obtained are therefore based on not more than about one year's usage. Since an essential feature of the Double-Three system is the periodic rest, usually occurring once a year or once in eighteen months, the true effects cannot be evaluated until a full cycle has been completed. Any conclusions based on the replies to the questionnaire must therefore be of a tentative nature, and the Research Scheme will not be in a sound position to make definite recommendations until at least a further year has elapsed. These remarks are clearly less applicable to the Double-Four system which does not involve a resting period.

NORMAL TAPPING SYSTEM

Question 1 in the questionnaire asked "What tapping system is normally employed?"

On the great majority of estates the normal system was alternate day tapping on one half-spiral cut (left to right), with variations as regards change of panel, and this system is taken as the standard with which the double-cut systems are compared.

INCIDENCE OF DOUBLE-CUT SYSTEMS

Question 2. "Have you recently adopted any other system or systems, and if so, what?"

Question 3. "Over what acreage has this/have these systems been employed?"

The following figures show the incidence of the double-cut systems as revealed by the replies to the questionnaire:—

Estates which have at any time adopted Double-Three system	66	
Estates which have at any time adopted Double-Four system	11	
Estates which have at any time adopted both double-cut systems	5	82
Estates which have not adopted either system (including 45 estates out of tapping).		92
Total number of estates from which replies were received		174
Total number of estates to which questionnaire was circulated		339

The Double-Three system must be sub-divided according to the length and frequency of the resting period. Either half of the estate is tapped and the other half rested in rotation (A.B.), the unit period being four, six or twelve months; or one third is rested in rotation (A.B.C.) for three, four or six months. The following figures show the number of estates and areas over which the different variations have been adopted.

System		No. of Estates	Acreage	
Double-Three				
A.B.	12/12	2	1,785	
	6/6	27	17,793	
	4/4	2	668	
A.B.C.	12/6	13	9,443	
	8/4	8	3,272	
	6/3	3	1,298	
No rest		1	83	
Resting period not stated		15	4,751	39,093
Double-Four		16		7,415
Total double-cut systems				46,508

It is difficult to ascertain to what extent the above figures represent the total incidence of the double-cut systems in Ceylon. The circulation of the questionnaire was limited to estates which had registered for the receipt of Research Scheme publications, and of these estates only about half the number submitted replies. It may be presumed that of the estates which did not reply the majority have not departed from their normal tapping methods, but on the other hand several estates are known which are employing a double-cut system but which are not included in the above analysis. The area of estate Rubber in tapping at the present time is not known with any accuracy and the proportion of this area which is being tapped under the double-cut system must at present remain a matter for conjecture. Since the questionnaire was circulated several new estates are known to have adopted double-cut tapping, and others, which were experimenting with the systems on a small scale, to have extended the acreage. It is anticipated, therefore, that at the end of 1933 the total area tapped by the double-cut systems will considerably exceed 50,000 acres, and that the increase will chiefly occur in the more recently introduced Double-Four system.

The figures show that the most popular variation of the Double-Three system is that by which half the estate is tapped and half rested for six months in rotation. In the drier districts the shorter tapping periods are preferred, the trees in no case being tapped for as long as twelve months in succession. The relative merits of the different cycles are discussed below.

DURATION

Question 4. "For what length of time has this/have these systems been employed ?"

Estates are classified below according to the year in which the double-cut system was initiated.

Year		Double-Three	Double-Four
1930	...	1	—
1931	...	10	—
1932	...	51	8
1933	...	4	8
Not stated	...	5	—

It is seen that the majority of estates adopted the Double-Three system in 1932, the Double-Four system being the more recent introduction. As is pointed out above the first cycle under the Double-Three includes a period during which the trees have not had the benefit of a previous rest, and the results of the first year are therefore not fully representative. In considering the figures for yield etc. greater importance is therefore attached to the results obtained from the few estates which have tapped in the second and succeeding cycles, than from the many estates on which the initial period is still included.

AGE OF TREES

Question 5. "Age of trees tapped by new system?"

This question was asked in order to determine whether the double-cut systems were equally suitable for trees of all ages. Most of the information refers to fully mature trees, and no tapping results or expressions of opinion are given regarding the suitability of the Double-Three system in young clearings. One instance of Double-Four tapping in a seven year old clearing is, however, cited, and the promising yields obtained in the first two tapping years indicate that this system is probably well suited to young seedling trees. No opinion can be expressed as to whether two cuts with the shorter interval will prove too severe for young trees.

Question 6. "What yield per acre has been obtained as compared with normal system?"

Question 7. "What yield per tapper has been obtained as compared with normal system?"

The answers to these questions have usually involved a comparison between the period (year, years or months) of double-cut tapping and a corresponding earlier period under the normal alternate day system. Uncontrolled comparisons of this nature are far from satisfactory, but in the absence of any data from well designed field experiments such are the results on which conclusions must at present be based. The results will become increasingly reliable as the local variations caused by weather conditions, out-turn of tappers etc. become smoothed over by time.

In the figures given below the yield per acre per annum is expressed as a percentage of the full yield under normal alternate day tapping, the yield being calculated over the whole area including the portion being rested. The average figure, calculated on an estate rather than on an acreage basis, and the limits of variation are given for each system, all variation of Double-Three (A.B.) and of Double-Three (A.B.C.) being grouped together. The yield per tapper, taken together with the comparative size of the tapping task, has been used to confirm the figures given for yield per acre; in cases where the replies to the two questions do not appear to tally it is supposed that the total number of tapping days in the two periods under comparison must have been markedly different.

System	Average	Limits of Variation
Double-Three A.B. ...	77%	55-97%
Do. A.B.C. ...	93%	80-107%
Double-Four ...	100%	80-114%

Discussion. (*a*) *Double-Three System.*—The above figures show that the average yield under A.B. tapping is 77 per cent., and under A.B.C. 93 per cent. of the full normal crop. The large degree of variation exhibited can be explained by the short period over which most of the comparisons were made, local variations being thus brought into greater prominence, and the fact that the observations are recorded from many districts.

On the majority of estates the results include the initial period during which the trees have not received the benefit of the periodic rest, and it therefore seems reasonable to suppose that in future years the yields will reach a higher figure. This is indeed borne out by an analysis of those estates on which the system has been in employment for more than a year, the proportions of the normal crop for these estates averaging 79 per cent. and 96 per cent. for A.B. and A.B.C. tapping respectively. It is significant that on the few estates which have two years' results to show, the yields obtained in the second year are always higher than those in the first.

Most of the results with the double-cut systems were obtained in 1932 which, owing to exceptionally wet weather in the last five months, was an unfavourable year for crop in most districts, and many Superintendents state that under normal conditions a larger crop would have been harvested. Thus on this account, also, the average figures from the questionnaire for percentage of normal crop are probably rather low.

Turning to the variations in the length of the resting period, estates which have adopted the A.B. system have mostly shown preference for a six month unit period. The two estates which are tapping for a year and resting for a year report satisfactory results, and it would appear that the twelve month period is not too long in wet districts. There is no evidence of any material difference in yield between the three variations of the A.B.C. system i.e. 12/6, 8/4 and 6/3. Whereas tapping for a year and resting for six months (12/6), with the less frequent change involved, is probably best suited to a wet district, the shorter periods are rightly given preference in drier localities. When selecting the most suitable cycle for any particular estate other considerations such as rubber content (discussed below) must be taken into account.

To sum up, the information that is at present available indicates that in the main low-country districts the Double-Three system, after it has been in force for a full cycle, may be expected to yield about 80 per cent. or 100 per cent. of the full normal crop according as to whether the A.B. or A.B.C. system of periodic rest is employed. The suitability of the double-cut systems in dry districts and at high elevations is discussed later under a separate heading.

(b) *Double-Four System.*—The average yield per acre per annum from this system, as judged by the replies to the questionnaire, is 100 per cent. of that under normal alternate day tapping. This figure, however, includes one estate in a dry district from which very poor results are recorded; if this estate is excluded the average yield is 103 per cent. Most of the estates from which the results have been obtained have adopted the system for less than a year, and no great reliance can therefore be placed on the comparison with alternate day tapping. It would appear, however, that a slightly increased crop may be expected by the Double-Four system. Theoretically the total number of cuts is exactly the same as with normal alternate day tapping, and it is probable that the slightly higher yield is partially due to the greater amount of latex that can be collected in a hurry when "wash-outs" occur in wet weather. This advantage applies, of course, to any form of double-cut tapping.

SIZE OF TAPPER'S TASK

Question 8. "How many trees are allotted per tapper's task as compared with normal system?"

Since two cuts are tapped on each tree it is clear that the number of trees in a tapper's task must be less than when one half-spiral is tapped. Experience shows that about two-thirds of the normal task is the most economic figure, though this will vary according to the climate and terrain. The following figures give the average number of trees, and limits of variation, for the two types of tapping, Double-Three and Double-Four systems being considered together.

	Double-Cut	Half-spiral Alternate Day
Average	135	208
Limits of Variation	110-175	150-300

COST OF TAPPING

Question 9. "What is the cost of tapping as compared with normal system?"

The replies to this question are not very informative as the comparison is usually complicated by lowered wage rates. Taking the average figures for yield and size of task (as above), the costs of tapping for the double-cut systems expressed as percentages of half-spiral alternate day tapping are calculated theoretically as under:—

Double-Three		Double-Four
A.B.	A.B.C.	
65%	72%	75%

The cost of tapping is admittedly not a figure which can be very satisfactorily worked out on paper, but it is nevertheless clear that by adopting one or other of these double-cut systems a substantial economy in tapping costs can be effected. A comparison between the three percentages shown is hardly justified as the relation between yields obtainable by the different double-cut systems is not yet clearly established. It does appear, however, that the lowest tapping cost is associated with the Double Three (A.B.) system, though this may be offset by the higher proportion of overhead charges due to the smaller crop.

BARK RENEWAL

Question 10. "Have you made any observations regarding bark renewal as compared with normal system?"

The replies to this question are mostly favourable and no adverse opinions are expressed. In the early stages of renewal, however, it is hardly possible to compare differences amounting to less than a millimetre without making actual measurements on a representative number of trees. Such measurements have been made on a few estates, and the figures for thickness of renewing bark are in all cases higher for the double-cut system in question than for normal alternate day tapping. The methods employed, however, where stated, are open to criticism and it is not felt that a clear case for improved bark renewal has yet been established. The importance of this aspect of the tapping systems, if they are to be permanently employed, need hardly be stressed. The matter is receiving the close attention of the Research Scheme, and in the meantime we may say that observations so far recorded indicate that bark renewal is at least equal to that under half-spiral alternate day tapping.

BARK CONSUMPTION

Question 11. "What is the bark consumption as compared with normal system?"

The following figures show the average bark consumption and limits of variation expressed as a percentage of the consumption under half-spiral alternate day tapping. It will be noted that there is a large variation in the figures recorded, and it seems probable that many of the replies were made without measurements from a representative number of trees being taken.

	Double-Three		Double-Four
	A.B.	A.B.C.	
Average	88%	107%	123%
Limits of Variation	70-133%	82-130%	114-130%

It is evident that the bark consumption is in all cases considerably higher than would be theoretically calculated from the number of tappings, indicating that in order to obtain a satisfactory flow a thicker shaving must be removed with the longer interval between tappings. On a well controlled estate the amount of bark consumed is the amount marked out or allowed for consumption, and one Superintendent who has obtained disappointing yields with the Double-Three system admits that sufficient consumption was not permitted. With the exception of the figure 88 per cent. for Double-Three (A.B.) tapping, which is thought to be rather too high, the averages given above are probably not excessive if the best results are to be obtained.

No distinction has been drawn between the different cycles in the Double-Three system, but the consumption will clearly be slightly higher with the more frequent change.

Whether the bark consumption under the double-cut systems is excessive must depend on the rate of renewal and bark reserves on the particular estate. If experiments show a tendency to improved renewal this must be taken into account in offsetting the higher rate of consumption.

RUBBER CONTENT

Question 12. "What is the average rubber content of the latex as compared with normal system?"

(a) *Double-Three System.*—Estates which have replied to this question are classified according to whether the latex has been observed to have a higher, lower or about the same average rubber content for the year as compared with normal alternate day tapping. Actual figures for lb. dry rubber per gallon are not given since accurate determinations are seldom made on estates.

Higher	rubber	content	5 estates
Lower	,,	,,	16 ,,
Same	,,	,,	20 ,,

It is the general experience that for some weeks after a resting period the rubber content is high, but that it gradually falls off after a longer or shorter period of time. An equilibrium is probably reached below which figure it will fall no further. The time for which the content is maintained at a normal level appears to vary greatly on different estates, and should be one of the main factors influencing a decision as to the most suitable

that year, for which many factories had insufficient drying accommodation. It is possible, however, that the latex, particularly from four-day tapping, is comparatively rich in non-rubber substances and that the liability to mould development and discolouration by oxidation is thereby increased.

It is concluded that estates which do not normally experience trouble with crepe manufacture are unlikely to find difficulty with a double-cut system, but that where trouble is liable to occur with alternate day tapping this may be accentuated. There is no reason, however, to suppose that any difficulties cannot normally be overcome by increased attention to all details connected with manufacture.

SUITABILITY OF SYSTEMS IN DIFFERENT DISTRICTS

In the main moist low-country districts there appear to be no serious agricultural objections to either of the double-cut systems. Various minor disadvantages are mentioned in the replies to the questionnaire, but with only one exception the systems appear to have fulfilled their main purpose of reducing the cost of tapping; (on this particular estate the Superintendent admits that insufficient bark consumption was permitted). The initiation of the Double-Three system may result in a shortage of crop during the first tapping period, but there is no recorded instance of continued disappointing yields after the trees have benefited from the periodic rest.

In drier localities and at higher elevations, on the other hand, experiences appear to be very diverse. In the Kurunegala District, for example, five estates are employing the Double-Three system (A.B. or A.B.C.) with success, while one estate has abandoned the A.B. system, finding that with the three day interval the bark dried up too much between tappings. The rainfall on this estate is no lower or worse distributed than on the other estates in the same district, and it is not easy to account for the different results. Possibly sufficiently thick shavings were not being removed, or the tapping tasks allotted were too large. There is no *a priori* reason for supposing that the three day interval should be too long in dry districts since tapping on one cut every three days has often been successfully employed as a mild form of tapping in such localities.

In Uva Province the Double-Three system has been found unsuitable on two estates in the Haputale District, one in Koslande and one in Moneragalla, the rubber content of the latex in each case being found to fall to a low figure after a short

period. These estates, in addition to experiencing a low and unevenly distributed rainfall, are also at a relatively high elevation, a combination of circumstances which is not favourable to growth, production, or bark renewal. It would seem, therefore, that the double-cut systems are not suited to these localities, the severity of the tapping not being adequately compensated by the resting period.

There is little doubt that in dry districts preference should be given to a short rotational cycle, and on an estate in an average condition of cultivation the trees should probably not be tapped for more than six or eight months in succession. On this account the A.B. system is the sounder from an agricultural standpoint, though some estates could possibly not afford the smaller crop.

Records of the Double-Four system have only been received from one estate in a dry district. The yields have been very disappointing, and the Superintendent attributes the poor results to the long tapping interval during which the bark becomes dry and hard. It is impossible to predict whether this experience will be general in similar localities, but in the meantime the system cannot be recommended in dry districts except on an experimental scale.

An important consideration in dry districts is the incidence of Brown Bast, the occurrence of which is markedly dependent on the tapping system employed. One or two Superintendents express the opinion that fewer new cases occur with the double-cut systems. This, indeed, may prove to be the case since the extraction of latex is locally less severe than under alternate day tapping, but it is at present impossible to make an authoritative statement on the matter.

PRACTICAL CONSIDERATIONS

There are certain practical considerations in connection with double-cut tapping which may conveniently be presented in a list of advantages claimed for, and objections raised against, the systems. Most of the salient points have already been discussed under the appropriate headings.

ADVANTAGES

(1) Economy in tapping costs. This is the "raison d'être" of the double-cut systems and has been fully discussed above.

(2) Reduction in labour force, with its attendant advantages such as less line accommodation, etc.

(3) Greater ease of supervision as the result of the tapping on any one day being concentrated in a smaller area.

(4) More latex can be collected in the event of a "wash-out" in wet weather.

(5) Improved bark renewal: this has not yet been clearly established, and in the case of the Double-Three (A.B.C.) and Double-Four systems is counteracted, to an extent at present undetermined, by a higher rate of bark consumption.

(6) If Double-Four tapping is contrasted with the single cut alternate day system with an annual or six-monthly change of the tapping panel, the former has the advantage that there is no re-opening of cuts with its attendant difficulties in crepe manufacture and increased liability to Bark Rot if the weather is wet. If tapping is suspended during the wintering period, however, the cuts are of course re-opened after the short rest. It is not at present known whether this rest will be found desirable with the Double-Four system.

OBJECTIONS AND DIFFICULTIES

(1) Labour. Should the double-cut system selected be found unsuitable for the particular estate difficulty might be experienced in recovering the full number of tappers required for alternate day tapping. This objection carries considerable weight in districts where labour is difficult to obtain, but the risk can be largely obviated by a preliminary trial of the system on a small area.

(2) Supervision. Very strict supervision is necessary during the first new months of a double cut as of any new tapping system. The consumption of bark must be carefully regulated, and there is a liability of the coolies who were formerly accustomed to bring in, say, 10 lb. of rubber a day, being satisfied with a similar instead of a considerably higher intake. At first, also, the tappers are apt to arrive late at the factory, but this can usually be rectified when they have become accustomed to the new system.

(3) The double-cut systems cannot be easily adopted on estates where there is a scarcity of bark on one side of a large proportion of trees. In Ceylon an annual or six-monthly change-over of the tapping panel is the general rule so that this difficulty should not apply to many estates.

(4) The higher rate of bark consumption under the Double-Three (A.B.C.) and Double-Four systems may prove a serious objection unless balanced by improved bark renewal. This has been discussed above.

(5) The fear is often expressed that if the two cuts are at approximately the same height the tree will suffer as the result of being virtually "ringed". This fear, however, does not appear to be justified by practical experience, and although it is clearly preferable to space the cuts apart if bark is available, on the average mature estate on which it has been customary to make an annual or six-monthly change-over on a single cut system, the cuts may safely be opened at the existing levels.

(6) The frequent resting and re-opening of cuts is probably the most serious practical objection to the Double-Three system where a short cycle is found necessary. Where the A.B.C. system is in employment, however, half the area being tapped will be yielding latex of a good colour, and by bulking this with the yellow latex from the new cuts the temporary difficulty of making crepe with a good colour can be largely overcome. With the longer periods of rotation the Double-Three system is not at a disadvantage in this respect as compared with the normal procedure in Ceylon.

(7) It has been suggested that the resting of a portion of the estate will lead to that area being neglected as far as weeding and disease treatment is concerned. There are not many estates in Ceylon, however, on which weeds under mature Rubber would become uncontrollable after six months' neglect, and unless certain undesirable species predominate, the growth of the weeds would probably be beneficial rather than harmful. The detection of fresh cases of disease is certainly more difficult in a rested area, but this is not likely to be a serious objection on the average estate unless the resting period is very prolonged; some planters, indeed, prefer to concentrate disease work on areas while they are being rested.

(8) Difficulty has been found on some estates in manufacturing crepe with a good colour, especially with the Double-Four system. This has been fully discussed above.

It is not claimed that the above lists include all points which can be argued for and against double-cut tapping systems. Each individual estate has its own problems, but it does seem that whereas the advantages are of fairly general application most of the objections and difficulties can be overcome under average conditions.

CONCLUSIONS

In the introductory section of this report the attitude of the Research Scheme to the double-cut tapping systems was stated to be one of cautious approval: while the systems could be recommended in most districts as a temporary measure in order to effect an economy in tapping costs, sufficient information was not available to predict their suitability for permanent adoption. To what extent must this statement be modified in the light of the observations and opinions expressed in the replies to the questionnaire?

Briefly stated, all variations of double-cut tapping have emerged from the enquiry with distinct credit. Except in certain localities where either one or all forms of double-cut tapping appear to be unsuited to the specific environmental conditions, the systems have achieved their main object of reducing the cost of tapping. There is at present no reason to believe that this economy has been effected at the expense of bark reserves or of the general health of the trees. There are minor objections to double-cut tapping, as indeed to any system, which have greater force on some estates than on others, but although further experience and information is needed before any definite pronouncement can be made it seems possible that double-cut tapping, in the form most suited to the individual estate, may largely supercede the normal alternate day system in most districts. It is significant that except in the localities mentioned in an earlier section there is only one known instance of an estate reverting to alternate day tapping after giving a double-cut system a trial.

The essential difference between the Double-Three and Double-Four systems concerns the period during which the trees are not tapped. Setting aside for a moment the Double-Three (A.B.) which is a milder form of tapping, the fundamental question arises as to whether the trees benefit more from the complete rest following after somewhat intensive tapping, or from the longer interval between tappings without a resting period. One Superintendent draws an ingenious analogy with

the human being, the four-day interval between tappings being compared with the week-end habit at Brighton, and the periodic rest associated with the Double-Three system with a lengthy recuperation at Biarritz. Such teleological inferences, however, are dangerous, and one believes that the rubber tree derives more physiological benefit from a periodic rest than the average person from a cure in a fashionable watering place.

In the present state of our knowledge we cannot say which is the better of the two systems, and unless some serious defect is revealed it is probable that both will maintain their protagonists. The Rubber Research Scheme is conducting a small-scale test with Double-Four tapping and is also associated with a larger experiment with the Double-Three (A.B.C.) system. Both these experiments provide a comparison with alternate day tapping on one cut, and it is hoped that their results will shed further light on the respective merits of the various systems.

The Double-Three (A.B.) system should probably be favoured in dry districts and on estates with a scarcity of bark, especially if circumstances do not demand a full crop. It appears to effect the greatest economy in tapping costs, and the yield may be expected to increase as the trees benefit from the relatively long periods of rest. Advantage, also, may be taken of the fact that with the less bark consumed per annum the tapping cuts may be kept at a lower and more productive level.

Each successive year increases the length of time since the last application of manure was made. The rubber tree responds slowly to starvation, but the probability that on most Ceylon soils the general health of the tree, as indicated by foliage, bark renewal and yield, will gradually deteriorate unless cultivation measures are resumed, must be borne in mind in discriminating between different methods of tapping. It would be most unwise at this juncture to adopt a drastic tapping system unless replanting is contemplated, and there are those who fear that the double-cut systems may prove to be unduly severe. Present indications, however, do not point in this direction, and it would appear rather that intelligent use of the double-cut system most suited to the individual estate may provide a cheap and efficient means of extracting latex without any undue tax on the resources of the tree.

ACKNOWLEDGMENT

It is a pleasure to acknowledge the valuable information and opinions received from many Proprietors, Agents and Superintendents, without which this report could not have been written.

PROVED HEVEA CLONES—II

CLONES IN MALAYA AND THE DUTCH EAST INDIES

R. K. S. MURRAY, A.R.C.S.,

MYCOLOGIST, RUBBER RESEARCH SCHEME (CEYLON)

FOREWORD

THIS report is the second of a series of notes, the object of which is to keep the planter in Ceylon in touch with the performance of the imported clones established in his clearing or nursery. The first of the series was published in Rubber Research Scheme *Quarterly Circular* Vol. 9, Parts 1 and 2, and the present report extends the information to the latest tapping year. Notes on Ceylon clones are being issued in a separate series.

No attempt has been made to give an inclusive account of all proved clones from Malaya and the Dutch East Indies. Only those believed to be of interest to Ceylon planters are mentioned, and clones which are no longer specially recommended by those in the best position to judge have been omitted. Their omission does not necessarily imply that they have developed any new undesirable characteristics; in many cases they have been superceded as the choice of high-yielding material has become wider. Information regarding clones not yet introduced to Ceylon will be given in subsequent reports should their performance become of outstanding interest.

The results are presented in a somewhat different form to that adopted in last year's report. The yields of the best Malayan clones are given together in Table I, and of those from Java and Sumatra in Table II. The separation of the clones into these two classes has not been done on geographical grounds alone. A comparison of the yields from Malaya with those from the Dutch East Indies is not justified without taking two factors into consideration.

(1) Growth in Malaya is, in general, more rapid than in Java or Sumatra, so that at any age the young budgrafts are more advanced.

(2) Tapping of the Malayan clones is in all cases on half the circumference, whereas in Java and Sumatra most of the yields are derived from one-third of the circumference.

The yields are expressed in lb. of dry rubber per tree per annum, and in order to make the figures comparable they are calculated on a basis of 160 tappings. (To convert the figures to grams dry rubber per tapping they should be multiplied by 2·84. This will facilitate comparison with the performance of the young Ceylon clones given in R.R.S. *Quarterly Circular*, Vol. 10, Part 2.) It must be recognised that these are calculated rather than absolute figures, but since the number of tappings in the year has usually approximated to 160 the error introduced is small. The yields are given according to age, calculated to the nearest half year from the date of establishment (budding or planting of budded stumps) to the middle of the tapping year. The tables also give the situation, the year and month of planting or budding, the number of trees under test and the tapping system employed. In the last column the following abbreviations are used:—

a.d. = tapped alternate daily,

d.a.m. = tapped daily in alternate months.

Buddings of the second "vegetative generation" of some of these clones are now in tapping, and the records published to date are given in Table III. Most of the well-known Java and Sumatra clones have been established on an experimental clearing at Tjiomas, Java, and the yields from these young buddings will provide a good comparison of the various clones.

In the publication mentioned above full particulars were given regarding the conditions under which the trees are tapped and the yields recorded, and for this information the reader is referred back. The notes on the characteristics of the individual clones, also, are not repeated, but are supplemented by any new features which may have developed or new information come to hand.

Up to the present all the yield records and most of the other observations are derived from the countries in which the clones originated. It is hoped that from 1934 onwards it will be possible to publish data regarding the performance of these foreign clones in Ceylon.

In the current issue is reproduced a translation of a lecture given in Java by Ir. J. S. Vollema, in which the most recent information regarding the Java and Sumatra clones is given, and certain aspects of the use of buddings as planting material fully discussed. Attention is particularly directed to the yields obtained from relatively large areas of budgrafts tapped on a commercial scale, and to their close general agreement with the figures recorded from small scale test-tappings. For convenient reference these practical figures have been reproduced in tabular form in Table IV.

PRANG BESAR CLONES

These clones are established and tested under careful supervision on Prang Besar Estate, Malaya, a point which is particularly stressed by the Estate being that the trees are tapped under strictly commercial conditions. Yields and other information regarding the best clones are issued annually in pamphlets, from which most of the following information is abstracted.

The six best clones for which yield records for 1932 have been issued are Nos. 23, 25, 86, 180, 183 and 186. Nos. 24 and 123 have been omitted from the list given last year, and No. 180 added.

As shown in Table I the number of trees in test-tapping is in all cases 10. The number of trees in each clone actually under observation is, however, considerably larger, and tests have shown that the average yield from the 10 trees in test-tapping is substantially the same as that from the total number of trees in the clone.

With regard to the yields, it is stated that the crop for 1932 was interfered with by weather to an exceptional degree, and this presumably accounts for the slight decrease in the yield of some of the clones.

The following notes supplement those given last year:

P.B. 23.—Early growth is weak and variable, but from the second year onwards there is a marked increase in vigour and general evening-up in size. The trees are showing satisfactory growth in a poor lateritic soil at Nivitigalakele. The bark is soft and easy to tap. Five cases of Brown Bast have been reported out of 63 trees under observation.

P.B. 25.—Growth is very variable, but has so far been quite good at Nivitigalakele. Yields from buddings of the second "vegetative generation" promise to confirm the high yield of the original trees.

P.B. 86.—Nothing new to report. This is the youngest of the proved Prang Besar clones, and for its age is second in yield only to P.B. 186.

P.B. 180.—Growth is stated to be good, the crown being particularly large. Bark renewal is moderately good and wound recovery satisfactory. The clone is somewhat late maturing, but has been the second highest yielder during the last two years.

P.B. 183.—Nothing new to report.

P.B. 186.—This clone has been by far the highest yielder among the Prang Besar clones for the last three years. As explained above the decline in 1932 is attributed to bad weather conditions. Growth is vigorous even under poor conditions. The bark is thick but rather hard, and requires careful tapping in early years. Nine trees have developed Brown Bast out of 261 trees under observation.

OTHER MALAYAN CLONES

For information regarding these clones we are indebted to notes published by the Rubber Research Institute of Malaya. The clones have been established at the Rubber Research Scheme Experiment Station, Nivitigalakele.

Sungei Reko 9.—This clone was established on Kajang Estate in October-November 1921, and has been tapped continously under commercial conditions since 1927. Its yield is not as high as the best Prang Besar clones but is the average of as many as 84 trees. The growth in the first year or two is very vigorous and uniform under all conditions, though the clone is not actually one of the quickest to come into tapping. Clone S.R. 9 seems to possess no serious defects.

Glenshiel 1.—This clone was established on Glenshiel Estate in November-December, 1921. The yield records given in Table I are derived from 20 trees, but there are six further groups of 20 trees each tapped on different systems, and, in addition, 180 trees are under observation in normal commercial tapping. The slight decrease in yield during the last two years is accounted for partly by the fact that the 1930 yields were rather high, the trees having benefited from a rest during the last six months of 1929, and partly by the fact that in 1932 the cuts were only a few inches above the union. The opening of a new panel at 40 inches in October 1932 resulted in an immediate increase in yield. The tree is moderately vigorous,

TABLE I

MALAYAN CLONES

Clone	Where planted	When budded	No. of trees	Yield in lb. dry rubber per tree per year of 160 tappings at an age of (to nearest half year)													Tapping system
				4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	10½	
P.B. 23	Prang Besar	IV. 1922	10				13·6		15·9		16·5		21·5		20·7		½ sp.a.d.
P.B. 25	,,	IV. 1922	10				12·4		13·9		15·1		20·1		22·1		,,
P.B. 86	,,	X. 1923	10	10·2		12·3		14·9		18·5		21·1					,,
P.B. 180	,,	IV. 1922	10				12·1		13·4		14·4		22·9		22·6		,,
P.B. 183	,,	VI. 1923	10		8·4		13·2		15·3		20·4		20·4				,,
P.B. 186	,,	IV. 1922	10				11·2		15·6		20·6		27·6		26·3		,,
S.R. 9 (Sungei Reko)	Kajang	XI. 1921	84					10·7		16·5		17·2		17·9			,,
Gls. 1 (Glenshiel)	Glenshiel	XII. 1921	20					10·7		11·1		22·7		22·4		22·2	,,
Rub. 393 (Rubana)	Rubana	XII. 1921	9-8					14·9		15·0		23·3		24·2		28·7	½ V. a.d.
Sab. 24 (Sabrang)	Sabrang	X. 1921	17					12·6		20·6		19·7		22·6		31·3	,,

virgin and renewed bark being entirely satisfactory. "Dry" patches have occurred on several cuts on a half-spiral, and this clone appears to respond better to tapping on one-third of the circumference.

Rubana 393.—This clone was established on Rubana Estate in December 1921, and the 9-8 buddings have been tapped continuously since April 1928. The growth is of average vigour with prolific branching and a heavy crown. Virgin bark is of moderate thickness and renewal satisfactory. One case of Brown Bast has occurred, but no other disease has been reported.

Sabrang 24.—This clone was established on Sabrang Estate in October 1921. Twenty trees were originally test-tapped, of which 17 have been tapped continuously since April 1928. In 1932 the yield reached the high figure of 31·3 lb. per tree. Growth is fairly vigorous and branching sparse. Virgin bark and renewal are excellent. No case of Brown Bast or other disease has been reported, but two trees have gone dry and one was damaged in a storm.

A.V.R.O.S. CLONES

The buddings of the A.V.R.O.S. clones are planted on various estates and experimental gardens in Sumatra, the test-tapping being under the general supervision of the A.V.R.O.S. Proefstation. Some of the clones have been test-tapped on more than one estate, and the records from the various situations are given in Table II. A comparison of the relative merits of two clones is clearly of greater value if based on the average results from various localities, than if it is merely a comparison of one clone on one estate with the other clone on a different estate.

The clones specially recommended by the A.V.R.O.S. Proefstation are Nos. 49, 50, 152 and 256, and only these clones are included in Table II. These are the same clones to which preference was given in last year's report, and the manner in which the older clones have maintained their position is worthy of note. The other older clones have been discarded on account of undesirable characteristics or because their yield has not increased according to expectations. There is also a number of newer clones, the yields of some of which promise to exceed those of the older clones. So far as is known these have not yet been introduced to Ceylon, but data will be given in future reports if their performance becomes outstanding.

Second generation buddings of Clones 50 and 152 are being test-tapped on an experimental clearing at Tjiomas, Java, and the yield records are given in Table III. In general, the A.V.R.O.S. clones are giving lower yields in Java than those obtained from the original buddings on the East Coast of Sumatra at the same age. This is probably due to the milder system of tapping and the slower growth in Java. In Malaya, on the other hand, where growth is more rapid, the A.V.R.O.S. clones are reported to be giving substantially higher yields than at the same age in Sumatra.

The following notes supplement those given last year:

A.V.R.O.S. 49.—There are no new features to report. The resistance to conditions of drought should make this clone very suitable for relatively dry districts, such as Matale and Uva. The buddings show very uniform and rapid growth on a wide range of soil types, and are resistant to wind damage.

A.V.R.O.S. 50.—This clone is a vigorous grower, but is more susceptible to soil conditions than A.V.R.O.S. 49. It is stated to grow badly where natural grasses have been allowed to remain. The buddings are extremely resistant to wind damage.

A.V.R.O.S. 152.—This clone is very sensitive to soil conditions and the growth is therefore extremely variable, being particularly bad under grass. Like A.V.R.O.S. 49 it is resistant to drought and shows only a slight yield decline during the wintering period. The trees are somewhat susceptible to damage by wind.

A.V.R.O.S. 256.—There is no information to add to the notes given in last year's report. Young buddings in a nursery at the Experiment Station, Nivitigalakele, have shown quicker growth in the first year than any of the other imported clones, but the growth is believed to be somewhat variable. Little damage due to wind has been experienced.

BODJONG DATAR CLONES

An area of mixed buddings was established on Bodjong Datar Estate, Java, in February 1918, and was first tapped in 1922. The various clones were not, however, identified until 1926, and the test-tapping records date from June of that year. With the exception of a rest for five months in 1927 the trees have been tapped continuously on alternate days on a 1/3 spiral cut.

TABLE II

JAVA AND SUMATRA CLONES

Clone	Where planted	When planted	No. of trees	Yield in lbs. dry rubber per tree per year of 160 tappings at an age of (to nearest half year) 4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12	12½	13	13½	14	14½	Tapping system
A.V.R.O.S. 49	Polonia	VII. 1919	4		3·7*		7·2*		11·5*		12·6*		12·2		15·2		19·4		22·7						½* & ½ sp. d.a.m.
,,	Tjinta Radja	V. 1920	112-89		5·1*		7·5*		8·9*		10·8		12·3		15·8										,,
,,	Boekit Maradja	X. 1922	25			8·8*		10·0		13·8															,,
,,	Peoloe Tagor†	I. 1922	15							7·5*		8·6													,,
A.V.R.O.S. 50	Belawan	I. 1919	10 9			5·3*		11·3*		12·4*		10·7		10·9		14 1		16·0		13·7					,,
A.V.R.O.S. 152	Boekit Maradja	X. 1922	100	6·0*		8·3		11·7		14·4															,,
,,	Peoloe Tagor†	I. 1922	20							6·2*		8·2													,,
,,	Aloer Djamboe	end 1922	25							9·0															½ sp. d.a.m.
A.V.R.O.S. 256	Tamiang	X. 1920	8-20							14·7		16·3		14·7		16·6									⅓ sp. d.a.m.
B.D. 5	Bodjong Datar	II. 1918	8-5										17·4			25·0		24·2		27·0		27·7		33·4	⅓ sp. a. d.
B.D. 10	,,	II. 1918	50-44										15·7			18·7		18·7		18·0		20·1		20·1	,,
,, (War. 6)	Pasir Waringin	1918	23-20																(17·8)		(21·3)		(27·5)		,,
Tjir. I.	Tjirandji	1920	5-2									27·0*		24·0		31·6		37·0		29·7*					⅓* & ¼ sp. a. d.
Tjir. VIII.	,,	1920	34									13·9		14·7		15·8		16·1		17·4					⅓ sp. a. d.
Tjir. XVI.	,,	1920	11									21·2		21·8		18·0		19·1		24·3					,,
Djas. I.	Djasinga	1920	150-144											(9·8)		13·3		12·6							,,

† On replanted land.

* See under "Tapping system"

Figures in brackets are approximate, the number of tappings not being known.

Clones B.D. 2, 5 & 10 attracted early attention, but B.D. 2 developed various undesirable characteristics and has been discarded from planting recommendations. Other Bodjong Datar clones are moderately high yielders but are not of interest to Ceylon planters.

B.D. 5.—The yield of this clone in its fifteenth year attained the high figure of 36 lb. per tree for 173 tappings. This represents a considerable advance on the previous year, and it would appear that the yield is still on the increase. The yield of the second generation buddings on Tjiomas is also satisfactory.

There is often a delay in the shooting of the buds, but early growth is vigorous. The buddings have a very late branching habit, however, and on this account the girth increase is slow. The small crown is probably responsible for the great resistance of this clone to any form of damage by wind. Growth is very uniform and there is evidence to show that B.D. 5 may prove one of the most vigorous clones on replanted land. In the wet districts of Ceylon the clone suffers as the result of being particularly susceptible to attack by *Phytophthora palmivora* on the young green shoots. Provided this disease can be controlled in the early years the budgrafts subsequently show satisfactory development, but the trouble thus incurred, and the probability that the mature foliage will be susceptible to "secondary leaf-fall", have checked the extensive use of this clone in Ceylon.

B.D. 10.—The yield of this clone is considerably lower than that of B.D. 5, but being derived from 44 trees is a more reliable average figure. The clone is also established on Pasir Waringin Estate under the name Waringiana 6, and here the yield showed a big rise in 1932. The young plants on Tjiomas are also yielding well. Early growth is very vigorous and uniform. An unsatisfactory feature of this clone is the tendency to form a twisted or corrugated stem, but this is stated not to interfere with tapping. Out of 68 trees, 8 have been affected with Brown Bast.

TJIRANDJI CLONES

The Tjirandji clones were planted on Tjirandji Estate, Java, in 1920, and are test-tapped under the supervision of the Proefstation West Java. Clone Tjir. I has probably been more extensively planted in Ceylon than any other clone.

Tjir 1.—The yield of the two original buddings, although very high, has shown a marked decrease in 1932, despite the cut having been changed from 1/4 to 1/3 circumference. Such fluctuations, however, are to be expected when the average is derived from only two trees. On account of this small number of trees (three out of the original five buddings were destroyed by a storm in 1929) the exceptionally high figures have been accepted with a certain reserve. It is now fortunately possible to give yield records from a relatively large number of second generation buddings (see Table III), and their good performance in several clearings has materially increased one's confidence in this clone.

TABLE III

SECOND GENERATION BUDDINGS

Clone	Where planted	When planted or budded	No. of trees	Yield in lb. dry rubber per tree per annum at age of (years)			Tapping system
				$4\frac{1}{2}$	5	$5\frac{1}{2}$	
P.B. 24	Prang Besar	XI. 1927	142		6·1*		$\frac{1}{2}$ sp.a.d.
P.B. 25	,,	XI. 1927	139		6·0*		,,
A.V.R.O.S. 50	Tjiomas (Java)	IV. 1926	1-13	3·3		3·3	$\frac{1}{3}$ sp.a.d.
A.V.R.O.S. 152	,,	IV. 1926	2-3	3·5		4·4	,,
B.D. 5	,,	I. 1927	5-10			5·3	,,
B.D. 10	,,	I. 1927	12-14			4·4	,,
Tjir. I	Tjirandji	1927	24-33			4·6	,,
,,	Tjimatis	1927	110-219			5·3	,,
,,	,,	1928	153-265	3·5			,,
,,	Tjiomas	I. 1927	10-15			5·5	,,
Djas. I	,,	IV. 1926	3			3·3	,,

* Calculated from three months' tapping.

The trees show very vigorous growth, being uniform under most conditions. The clone possesses three defects, one or all of which may be of importance in certain districts and situations:

(1) It is distinctly susceptible to wind damage.

(2) Its yield is markedly depressed in conditions of drought and during the wintering period.

(3) The latex tends to flow until the early afternoon.

Tjir. VIII.—The yield of this clone, though showing a steady annual increase, is only moderate, and in Java the clone is only recommended for mixed planting. So far as is known it possesses no serious defects.

Tjir. XVI.—The yield in the thirteenth year has shown a big increase. Growth is slow, but primary and secondary bark are very good. There is no record of susceptibility to disease or wind damage

CLONE DJASINGA I

This clone was established on Djasinga Estate in 1920, being one of the few original clones planted unmixed with other buddings. The yield is only moderate but the average is derived from as many as 144 trees. The slight decrease in yield in the twelfth year is attributed to root disturbance consequent on the removal of interplanted seedlings. The clone is now only recommended for mixed planting, but the records are given in this report as it has been fairly extensively established in Ceylon. A feature of Djas. I is the small crown which permits close planting.

COMMERCIAL TAPPING OF BUDDED AREAS

The question most frequently asked by the practical planter regarding the yield of budgrafts is: "Are the yields obtained by the test-tapping of a small number of trees going to be reproduced when large budded areas are tapped on a commercial scale?" This matter will not be discussed in detail here as it is fully dealt with in the translation of a Dutch paper reproduced in the current issue. Suffice it to say that the yields so far recorded give every indication of following the same trend as those obtained in the test-tappings.

The practical figures published to date are summarised in Table IV: other records of a similar nature are known but are not available for publication. When considering these figures, which at first sight may seem disappointing, it must be borne in mind that many of the clones which comprise these plantings have since been discarded, and that the tapping systems are mostly milder than those employed in Ceylon. Results of greater significance will be obtained when unmixed clearings of what are now regarded as the best clones come into commercial tapping.

TABLE IV

PRACTICAL YIELD FIGURES FROM BUDDED AREAS

Clones	Situation	Acreage in tapping	Year	Age (years)	lb. rubber per acre	Tapping system
Untested H.A.P.M.	H.A.P.M. E.C. Sumatra.	200	1929	9-10	1,000	½ sp. d.a.m,
,,	,,	5½	1928	8-9	1,104	,,
			1929	9-10	1,452	,,
B.D. 2, 5, 10 (proportions 3:1:5)	Bodjong Datar Java.	55½	-	5-6	404	½ sp.d. 15 days rest 30 days.
{ 215 ac. A.V.R.O.S. 36 } 52 ac. A.V.R.O.S. 36, 49, 50, 52, 80, 152, 163.	Aloer Djamboe, E.C. Sumatra.	267	1929	5-6	337	½ sp. d.a.m.
A.V.R.O.S. 36	,,	121	1930	6-7	543	,,
A.V.R.O.S. 33, 49, 50, 52, 80, 152.	Batang Trap, E.C. Sumatra.	42	1930	6-7	427	,,
Mixed.	Java	-	-	8-9	1,361	,,

"WHAT ARE OUR LATEST VIEWS REGARDING BUDDINGS AS PLANTING MATERIAL?"*

IR. J. S. VOLLEMA

The collected data regarding buddings and clones increases in extent from year to year, and our views regarding this question, which is of such importance to Hevea cultivation, are thus continually changing. A periodical review of the progress made and of the existing position, giving a critical analysis of the available information, is very necessary, and for various reasons the present seems a favourable time for such a review to be made.

In the first place our oldest budding gardens have now completed their fifteenth year of life, and have thereby—according to general belief—tided over the critical age.

Secondly, we are now beginning to derive the benefit of the systematic scientific work on Hevea selection that has been carried out in Java since 1926, in which connection the names of O. de Vries, Ostendorf, Vrolijk, Schweizer and s'Jacob must be mentioned. Thanks to this work a critical revision of clones on the basis of exact comparisons can now be commenced.

Thirdly, the time is opportune because we are now obtaining data with regard to commercial tapping of relatively large areas of budgrafts.

It is my aim today to regard the question entirely from the practical point of view, theoretical considerations being dispensed with as far as possible.

Giving a very brief judgment on the present position regarding buddings we may say that this form of planting material, taken on the whole, has proved quite satisfactory.

In these times of rapid progress it is well to recollect that about five years ago the practical planter was still very suspicious regarding the use of buddings as planting material. It was

[* Lecture by Ir. J. S. Vollema (translated from the Dutch text in *De Bergcultures VII, 15, 1933* on behalf of the Rubber Research Scheme, Ceylon) at the General Meeting of the Soekaboemi Rubber Planters' Association on the 25th March, 1933, at Soekaboemi.]

feared that buddings, being "artificial products", would be much weaker and more susceptible to diseases than seedlings, that the union would be a point of weakness, and that the bark renewal would be so bad that yields on renewed bark would show a considerable decrease. I once even heard budding characterised as "violation of nature". These pessimistic expectations, however, which many people even yet nurse in their hearts, have not withstood the test of proof.

The budgraft, as an "artificial product", is not on the whole weaker or more susceptible to disease than the seedling. The union is by no means a point of weakness in the tree; indeed the opposite is the case, for after lignification the union is really an exceptionally strong portion of the stem.

Bark renewal of buddings is not, in general, inferior to that of seedlings. I have just spoken of the critical age of buddings. By that I mean the age at which tapping is undertaken on renewed bark, as has been the case for some time with our oldest clones. With our Java clones, amongst others, there is no evidence of a consequent decline in yield; on the contrary the yields, as a general rule, seem to increase, as I shall show you presently. We have lately learned from a reliable source that the same fact has been observed on the East Coast of Sumatra; when the regenerated bark was tapped there was clearly an increased yield. Further reports are yet lacking, but we are in a position to state that the former fears of greatly decreased yields on tapping renewed bark are entirely disproved by these facts.

We can therefore say that the experience with buddings up to, and including, the fifteenth year has been satisfactory. To counteract the disappointing behaviour of some clones we have others which have exceeded expectations. On the whole the tentatively selected clones have done well. It is necessary to emphasise this fact in that it forms the gist of our practical advice of which I am now going to speak. Mr. Ostendorf communicated this advice fully at a Meeting held at Palaboean Ratoe in May 1931, and I will therefore merely remind you of it in brief.

As you know, the Experiment Stations have in the course of years selected a number of clones from among hundreds under observation, and have recommended them for planting out on a practical scale. This selection has been made on the basis of all collected data available over a given period, yield, of course, being given first consideration. But yield alone is not such an absolute criterion as has often been thought. The budding

gardens that are under observation are located under such varying conditions as regards climate, height above sea level, soil, planting distance etc., that the yields are not directly comparable; in addition all clones are not tapped on the same system. In collating the yields all these factors have to be taken into consideration. Within the groups of clones planted together a selection on the basis of production was less risky, but even in such cases we had to be careful that another factor was not concerned, namely the number of trees under observation per clone. Here I must pause to say something in this connection. The number of trees under observation per clone is of importance, not only because the reliability of the average yield per budding naturally increases with a larger number of trees, but also because, as I shall show you, a close connection exists between the number of trees under observation and the amount produced. We have usually observed, especially among the Java clones, that the production is higher as the number of trees is smaller. This is easily explained by the manner in which the buddings of most of the Java clones, which were originally planted mixed up together, were identified. Special attention was first paid to the high-yielding trees, and these were grouped into clones on the basis of seed or growth habit. Subsequently the clones were extended by the inclusion of trees which were identified purely by seed and habit. The disclosure of all the buddings in a clone has only been achieved in exceptional cases. It is therefore easily understood that the smaller the number of trees identified in a clone, the greater is the chance that only the highest-yielding trees have been found.

In comparing the production figures of different clones, therefore, one must take into consideration the number of trees per clone.

It is hardly necessary to point out that the value of a clone is determined not only by its capacity for production. There are many other characteristics that play an important part in testing clones, e.g. bark renewal, susceptibility to diseases, rate of growth, susceptibility to wind damage, and quality of the rubber. At this factor of "susceptibility to wind damage" I must pause for a moment. The impression has been gained that buddings are more susceptible to wind damage than are seedlings. Is this due to the wood of buddings being as a rule weaker than that of seedlings? Probably no. The cause apparently lies in the fact that buddings as a general rule form

larger crowns than seedlings and therefore catch more wind. One should therefore aim at the restriction of crowns and mutual support, this being most easily attained by a fairly narrow planting distance—an additional argument for close planting.

Even as the yield is influenced, so also are the qualities of "bark renewal", "susceptibility to diseases", "susceptibility to wind damage", and "rate of growth", which are referred to above, influenced to a considerable extent by height above sea level, climate, soil conditions, planting distance, etc. It will be clear to you that in testing the clones situated under such varying conditions it was impossible to evaluate all the above-named factors and precisely to balance the "pros and cons". This was all the more so as we could not be sure that some favourable or unfavourable errors or omissions had not been introduced. Such an objective selection would only have been possible on the basis of exact data from methodically laid out experimental gardens, wherein the clones, grown under similar environmental conditions, were compared on strictly systematic lines. Such exact information, however, has only been available very recently. A choice, nevertheless, had to be made years ago as the practical planter—quite rightly—had no intention of awaiting the exact data, but wished to plant out buddings and wanted advice about clones.

The Experiment Stations have therefore had to be satisfied with a subjective selection involving in its very nature a speculative element. A risk was involved in the planting of each tentatively selected clone. Nobody could predict what any clone tested under a certain combination of external circumstances would do under a different set of conditions: each individual clone might be better or worse in another locality. Distribution of the risk was therefore necessary, and we accordingly recommended that not one or a few but a considerable number of clones be planted with a view to assuring a good result from the average. This has been the fundamental basis of our advice and has remained unchanged up to the present day, although the form in which the advice was given has undergone some modification in the course of years as the result of knowledge gained from further data.

To be brief, I shall quote only our most recent advice. Expressed in popular terms it reads as follows:

"Do not restrict yourself to certain few clones but plant out at least ten. For planting on a large scale use only the best known clones viz: A.V.R.O.S. 49, 50, 71, 152, 256, B.D. 5 and 10, Tjir. I and XVI, and War. 1 and 4. These clones may be planted either mixed (polyclone) or pure (monoclone). If you plant polyclone then a number of less known but promising clones may also be established on a small scale, e.g. A.V.R.O.S. 150, 185, 214, Djas. I, Lampongiana 1 and 2, and Tjir. VIII. Do not plant these last named on the monoclone system".

We must be more precise as to the meaning of planting "on a large scale" and "on a small scale". Every individual will interpret these terms differently, and we will therefore define what the Experiment Station means by them. By "planting on a large scale" we mean ten per cent. of the area. If 100 hectares (247 acres) have been opened plant about ten hectares with each of the best known clones, either in blocks (monoclone) or mixed (polyclone). By "planting on a small scale" we mean at the most five per cent. of the area i.e. five hectares in a total clearing of 100 hectares.

So much has already been written regarding the advantages and disadvantages of mono- and polyclone planting that I must not say much more on the subject. We consider that the clones recommended for planting on a large scale have gradually become so well known that there is no objection to establishing them in monoclone. Theoretically, polyclone planting leads to higher average yields over the whole area than monoclone, but we are aware that the advantages of the latter system are often preferred by the practical planter.

As regards the clones recommended for planting on a small scale, the risk in monoclone planting is still considered too great. The well known instance of the areas planted with AV. 36, which on some estates in Sumatra were almost entirely destroyed by wind, is a warning example in this connection.

The advice so far given should be regarded as of a general nature. In special cases deviation to a greater or less extent may be justified. For instance, on the estates on which the above-mentioned clones were tested (and on neighbouring estates where similar conditions prevail), the risk of planting the locally tested clones is naturally much smaller than elsewhere. These estates can restrict themselves to their own clones. There may be many other similar exceptions, but as a general rule we adhere to our recommendations. At the present time we see

no reason for modifying this advice, though this may become necessary as the results from the systematic test-stations become available. As these test-stations are spread over the whole of Java it is also possible that we will be able to give recommendations to suit local conditions. Up to the present we have not reached this stage; yield figures are only available from the Experimental Station, Tjiomas,* at Buitenzorg, so that we have only been able to verify our general advice for the conditions prevailing at Buitenzorg. No alteration has been made in the selection of clones recommended for planting on a large scale, but the group recommended for planting on a small scale has been somewhat extended in the light of recent data.

I have collected in tabular form the most important data of the two groups of clones, and I will go over the figures with you now. We will then be able to review the various clones yet again, and discuss for each clone the most recently developed characteristics.

Table I contains the data regarding the clones recommended for planting on a large scale, and Table II those recommended for planting on a small scale.

The tables are arranged as follows:

In the first column are the names of the clones and, as you will see, they are arranged in alphabetical order. This is done on purpose in order to avoid giving the impression that within the two main groups a well founded selection is possible. There is an understandable tendency to place the clones within the group in an order of merit based only on yield figures, and to speak of the "very best clones" etc. It should be clear to you that in view of the tentative nature of the testing, on which I have laid stress, such an arrangement, unless confirmed by satisfactory data from systematic test-stations, is of no significance. In the second column of the tables is given the situation, in the third the year of planting, and in the fourth the number of trees under observation. Then follow eleven columns in which the yield in kg. (here converted to lb.) per tree per year in the consecutive tapping years is shown. As a rule the tapping years do not coincide with the years of the trees' life, and the differences are rounded

* Viz. the test clearings of April, 1926, and January, 1927, with 23 and 44 clones respectively. The average clone production in the fifth year of age in the 1926 clearing was 1·3 kg. (2·9 lb.) per tree; the average yield in the sixth year in both clearings was 1·6 kg. (3·5 lb.) per tree.

TABLE I

CLONES FOR PLANTING ON A LARGE SCALE

Clone	Where planted	Year of planting	No. of trees	Yield in lb. dry rubber per tree at an average age (to nearest half year) of 4½	5½	6½	7½	8½	9½	10½	11½	12½	13½	14½	Tapping system
AV 49	Polonia	1919	4	3·1	6·4	9·2	11·4	10·6	13·2	17·2					⅓ and ⅓ d.a.m.
,,	Tjinta Radja	1920	89			8·8	10·8	11·7	15·0						do.
,,	B. Maradja	1922	25		8·8	10·3	14 3								do.
,,	P. Tagor	1922	15				7·7	8·8							do.
,,	Betinga	1923	10			8·4									do.
AV 50	Belawan Est.	1919	9	2·2	4·8	11·2	12·5	10·6	10·8	14·5	16·5				do.
,,	TJIOMAS	1926	1-13	3·3	3·3										⅓ a.d.
AV 71	B. Maradja	1922	100	4·8	7·7	11·2	13·2								½ and ⅓ d.a.m
,,	Al. Djamboe	1921	25					13·9							do.
,,	Betinga	1923	10			10·1									do.
AV 152	B. Maradja	1922	100	6·4	8·1	12·1	15·0								do.
,,	P. Tagor	1922	20				6 6	8·4							do.
,,	Al. Djamboe	1922	25				9·2								do.
,,	Betinga	1923	10			9·7									do.
,,	TJIOMAS	1926	2-3	3·5	4 4										⅓ a.d.
AV 256	Tamiang Est.	1920	20				14·7	17·2	15·6						½ d.a.m.
BD 5	B. Datar	1918	7-6						18·5	25 3	26·0	26·6	29·9	36·1	⅓ a.d.
,,	TJIOMAS	1927	5-10		5 3										do.
BD 10	B. Datar	1918	50-44						16·7	18·9	20·0	17·8	21·1	21·8	do.
,, (War 6)	Ps. Waringin	1918	23-20									17·8	21·3	27·5	do.
BD 10	TJIOMAS	1927	12-14		4 4										do.
Tjir. 1	Tjirandji	1920	5-2					30·6	26·6	35·2	41·4	33·4			⅓ and ¼ a.d.
,,	,,	1927	24-33		4·6										⅓ a.d.
,,	Tjimatis	1927	110-219		5·3										do.
,,	,,	1928	153-265	3·5											do.
,,	TJIOMAS	1927	10-15		5·5										do.
Tjir. XVI	Tjirandji	1920	11					24·0	23·8	20·2	21·3	27·5			do
War. 1	Madjau	1918	13							16·1	20·0		31·2	29·3	do.
War. 4	Ps. Waringin	1918	30-27									20·2	31·7	28 2	do.
,,	TJIOMAS	1927	11-14		4·2										do.

off to the nearest half year. We have calculated the yields in kg. (here converted to lb.) per tree, not in kg. per hectare, in order to avoid giving the impression that it would be permissible to reckon in kg. per ha. the yields derived often from only a few trees. In the 16th and last column is given the tapping system employed.

On turning again to the first table we see in the first place that five A.V.R.O.S. clones have been recommended by the A.V.R.O.S. Experiment Station for planting on a large scale. These, the five AV. clones appearing in the table, are clones 49, 50, 71, 152, 256. Since the A.V.R.O.S. Experiment Station is in the best position to judge their own clones we have adopted their advice. In this connection I must remark that Clone 71 has no longer been recommended by the A.V.R.O.S. Station in recent years. This, however, is not because the clone should be rejected, but only because it has been found desirable to reduce the number of AV. clones. As we see no reason to follow this advice we still recommend this clone which has already become fairly widely established; many estates have obtained cheap planting material from which they can plant out.

The yield figures of the AV. clones on the East Coast of Sumatra which appear in the table have already been published by Heusser and do not therefore give rise to much comment.

Clones 49, 71 and 152 are situated in budded clearings on several estates in E.C. Sumatra. The fact that yields of one and the same clone may vary considerably even within the territory of E.C. Sumatra is a strong argument in favour of distributing the risks.

As you can see there are also yield figures available from Clones 50 and 152 in the fifth and sixth years of life at the Experiment Station, Tjiomas. These yields, with one exception, are lower than those from E.C. Sumatra. In the first tapping years the yields of buddings recorded from Sumatra have usually been higher than those in Java. Two reasons for this can be given. In the first place the buddings generally grow faster in E.C. Sumatra than in Java and therefore can be taken into tapping earlier, and in the second place the clones have been tapped more heavily during the first tapping years in Sumatra, viz. half the circumference daily in alternate months as compared with one-third of the circumference on alternate days in Java. In the meantime we may say that the yields of AV. 50 and 152 at the

Experiment Station, Tjiomas, are moderately good, so that for the present there is no need to depart from our recommendation of these clones.

Next on the list is Clone B.D. 5. The yield records of this clone up to, and including, the fourteenth year of life have already been published. You will see that in the fifteenth year the yield has again risen considerably. On Tjiomas the yield of B.D. 5 in the sixth year is also good.

There have recently been unfavourable reports regarding the quality of the rubber from Clone B.D. 5, and it is desirable here to give a word of assurance on the subject. The reports originate from an investigation made in London, where the results tended to show certain unfavourable characteristics. This investigation, however, is perhaps open to criticism, and in conjunction with the Experiment Station an extensive investigation has accordingly been undertaken, this time in America, the results of which are not yet known.

In anticipation of this extensive investigation, which will be published with all technical details, we can already make the following statements: If it should appear that the unsatisfactory property (referred to above) of the rubber of Clone B.D. 5 really exists, even then it is not serious, for this prejudicial character can probably be quite simply corrected in practice. For the present, therefore, we see no reason for revoking our favourable report on Clone B.D. 5.

Clone B.D. 10 has again shown a slight increase in yield in its fifteenth year; it gave nearly 10 kg. (22 lb.) per tree, which, for an average of 44 trees, is not bad. The same clone is also established on Pasir Waringin under the name of Waringiana 6, and there also the yields are good. On Tjiomas, too, the yield of B.D. 10 for the sixth year is above the average. A somewhat unsatisfactory feature of this clone is the tendency to form a more or less twisted stem which naturally renders tapping somewhat difficult. We do not, however, consider this defect to be of such importance that we should withdraw our recommendation regarding this clone.

Next we come to Clone Tjir. I. The recently published yield of this clone for its thirteenth year, although itself very high, has fallen considerably as compared with the twelfth year of its life. There is no entirely satisfactory explanation for this. On account of the small number of trees one would naturally not

expect the variations in individual production to be levelled out, and on account of this the estimation of the value of the clone is uncertain. Fortunately figures from young buddings of Tjir. I are now available. On Tjirandji Estate itself there is a small planting of this clone that originated by keeping spare plants in a budded clearing at certain distances. The average yield of these buddings, which certainly have not grown under ideal conditions, was 2·1 kg. (4·6 lb.) per tree in the sixth year; this is considered very satisfactory.

Of still greater value are the observations on Tjimatis where some hundreds of young seedlings, scattered over an area of 28 hectares, were budded with Tjir. I in 1926 and 1927. Very satisfactory yield records are available from a large number of these buddings viz. an average yield per tree of 1·6 kg. (3·5 lb.) in the fifth year, and 2·4 kg. (5·3 lb.) in the sixth year. At the Experiment Station, Tjomas, also, the yield of this clone for the sixth year has been very good viz. an average of 2·5 kg. (5·5 lb.) per tree. These figures considerably strengthen our confidence in this clone.

At Tjomas Clone Tjir. I suffered somewhat from wind damage, but in this connection I would remark that the buddings referred to form a border line which receives the full force of the storms that are of frequent occurrence on Tjomas. The Tjir. I buddings on Tjimatis have also had relatively more windbreaks, resulting from gusts of wind, than the neighbouring seedlings. When considering this clone one must take into account a certain degree of susceptibility to wind damage, against which protective measures can be adopted. Restriction of crown development and the encouragement of mutual support by a well judged planting density will usually reduce wind damage to a great extent. On stretches of land which are quite open and exposed to storms it would be preferable not to plant Tjir. I in monoclone.

The yield of Clone Tjir. XVI rose considerably in the [illegible] year. Moreover this clone gives the impression of being robust.

Then follow the two [illegible] Clones 1 and 4, which have both shown a decrease in yield during the last tapping year. Our faith in these clones, however, has not been greatly shaken. On Tjomas the yield of Clone War. 4 in its sixth year was above the average.

We now come to Table II which I will deal with more briefly.

TABLE II

CLONES FOR PLANTING ON A SMALL SCALE

Clone	Where planted	Year of planting	No. of trees	4½	5½	6½	7½	8½	9½	10½	11½	12½	13½	14½	Tapping system
				Yield in lb. dry rubber per tree at an average age (to nearest half year) of											
AV 150	P. Lapor	1922	6				9.5	9.7							½ and ½ diam.
	Al. Djamber	1922	25				8.8								do.
AV 185	S. Parapat	1922	4		7.0	11.7	13.2	15.6							do.
AV 214	„ A	1924	12	5.1	8.8	13.0									do.
„	„ B	1923	17		5.3	9.2									do.
BD 16	B. Daru	1918	15-14						12.1	12.5	16.3	18.2	20.[illegible]	21.8	do.
	EHOMAS	1927	10-12		4.0										do.
BD 17	B. Daru	1918	24-23						10.8	12.3	15.4	13.9	18.9	20.7	do.
	EHOMAS	1927	13-15		1.4										do.
Bb 1	Cult. tuin	1924-25	63		4.0	5.1	7.5	12.3	17.2						do.
	EHOMAS	1926	38	4.0	5.3										do.
Djas 1	Djasinga	1920	150-141						9.[illegible]	11.0	15.0	14.8			do.
	EHOMAS	1926	3		3.3										do.
G. T. 1	Gondang Tapen	1922	68					11.4	14.1	17.8					do.
Lamp 1	L. Kemala	1921	25					11.3	22.0	24.[illegible]	17.8				do.
„	„	1922	67				13.9	19.8	18.5	15.0					do.
„	Cult. tuin	1920	65							14.[illegible]	1[illegible].4	23.8			do.
Lamp 2	L. Kemala	1921	6					20.2	25.3	33.4	30.6				do.
„	„	1922	15				15.9	18.5	22.2	21.3					do.
Pil 2	Tjiandji	1920	64					20.2	15.8	19.6	25.[illegible]	34.8			do.
„ 3	„	1920	7					16.[illegible]	15.4	1[illegible]	19.4	21.8			do.
Tjir VIII	„	1920	34-35					15.8	16.3	1[illegible].6	18.0	19.6			do.
War 3	Malpin	1918	57-56							15.6	15.8	18.9	28.5	28.[illegible]	do.
War 8	„	1918	91-18							11.2	15.6	14.1	2[illegible].9	2[illegible]	do.
„	EHOMAS	1922	4-12		3.3										do.

In the first place you will see the A.V.R.O.S. Clones 150, 185, and 214, which are regarded as promising clones by the A.V.R.O.S. Experiment Station.

Then follow Clones B.D. 16 and 17 as new-comers to this group. In their fifteenth year these clones produced about the same as B.D. 10. In addition, on Tjiomas their yield in the sixth year was above the average. We therefore believe that these clones are fairly high yielders and can be recommended for planting on a small scale.

The same is the case with B.R.1 which, with 63 trees, has given a good yield at the Cultuurtuin at Buitenzorg, and also shows good figures at Tjiomas for the fifth and sixth years.

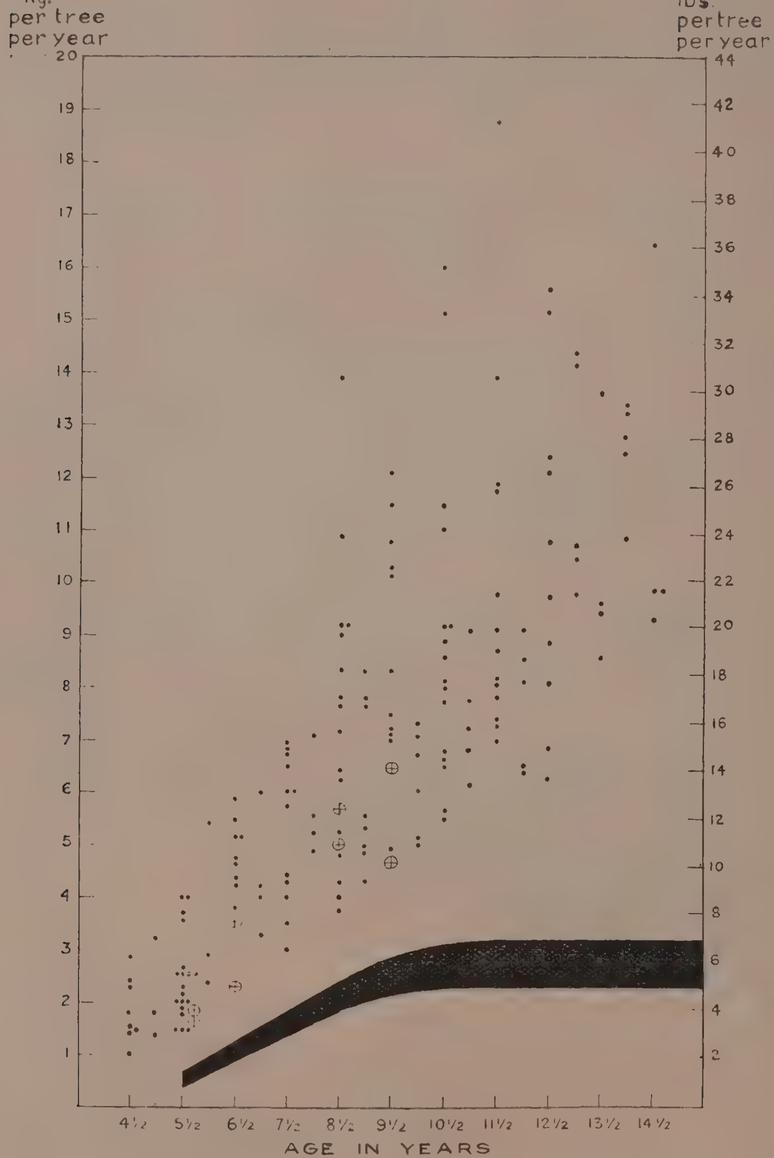
We now come to Clone Djas. I which occupies a unique position among our older clones in that the buddings, being planted out unmixed, could all be subsequently identified. Moreover, on account of the large number of trees under observation the average figure is very reliable. The yield has not, however, increased in the last tapping year on Djasinga, and in the sixth year on Tjiomas the yield was at about the average level. These are the only reasons for which this clone is still included amongst those recommended on a small scale.

The next clone, Gondang Tapen I, is also a new-comer concerning which the Experiment Station for Middle and East Java has recently given some information. The average yield of 68 trees is very promising.

The Clones Lampongiana 1 and 2 have given a smaller yield in the last tapping year, but in this case the decrease is easily explained. In the tapping year before last the clones were mostly tapped very deep, but in the last year a normal depth was reverted to. In the Cultuurtuin at Buitenzorg there are also six buddings of Lamp. I and the good yield of these trees tends to confirm our faith in the clone. Clone Lamp. 2 has a somewhat sensitive bark.

The next two clones, Planterstrots 2 and 3, are also new, and they are the highest yielders in the Planterstrots group of clones. The yield of Planterstrots 2 shows a very considerable rise in the thirteenth year but with this clone there is a susceptibility to Brown Bast.

Clone Tjir. VIII shows a regularly increasing yield which has been continued in the thirteenth year.



Kg.
per tree
per year
lbs.
per tree
per year
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
44
42
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
4½ 5½ 6½ 7½ 8½ 9½ 10½ 11½ 12½ 13½ 14½
AGE IN YEARS

Finally there are two further new clones, namely War. 3 and 8. These are inviting attention in the Waringiana group on account of their high yields, and have not up to the present exhibited any undesirable characteristics. Of Clone War. 3 there is a satisfactorily large number of trees under observation. War. 8 has given an average yield on Tjiomas in its sixth year

We have now finished with the tables.

If we now look into the yields of our clones more closely we should, first and foremost, be impressed with the idea that all records that appear in the tables ought by rights to be prefixed with a ± sign.

The averages may be regarded as more reliable than the individual figures. What is now the average yield of our clones in their successive years of life, and what course is taken by the average yield of buddings ? An answer to this question is most easily given with the aid of the graph to which I now wish to invite your attention.

In this graph the age in years is represented horizontally, and for each year is set out vertically the yield figures in kg. per tree of the clones dealt with in the tables. These are represented by the black spots on the graph, each of which, therefore, corresponds to a figure given in the tables.

You see that in the main these points lie in a breadthwise direction. A number of spots which lie out of the general grouping appear at the top, these being the yields of a number of Java and South Sumatra clones which probably form themselves into a class of their own. But these, almost without exception, are derived from only a small number of observed trees so that there is a chance of the yields being somewhat flattered. It would therefore be better to stand on safe ground and restrict our observations to the main trend of the graph. If we were to draw an imaginary line through it we arrive at average tree yields which, according to present conceptions, are very high. This is clearly demonstrated by the comparison with the yields of our existing plantations of unselected seedlings. These are shown by a thick black line towards the bottom of the graph. This kind of line is familiar to those of you who have seen it in former graphs; it is constructed from the well-known production curves of Bodde, Holle and Maas, and in this case represents the yields of our older seedling plantations calculated in kg. per tree per year. There is another point that stands out when we compare the

lines. The yields of the old seedling Rubber show no further increase after the eleventh year, whereas the yields of the budded clearings maintain a steady increase up to the fifteenth year. The probable explanation is that the older seedling plantations were usually overtapped in the early days and, according to present ideas, did not receive such good agricultural treatment as the budded clearings.

Now the comparison of the yields of our small budded clearings with those of the large areas of older seedlings is not strictly valid. We should really compare the yields of buddings on large areas with the old seedling plantations, and it is this comparison which is of chief interest to us from a practical point of view.

The practical man is not primarily concerned with yields obtained from buddings on a small scale; he wants to know whether these yields can be obtained from large areas.

We have therefore made a careful survey of yield figures that have recently been published as the result of tapping budded clearings on a practical scale. The available figures, which are expressed as kg. per tree per year in order to make them comparable, are shown on the graph as small crosses.*

As you may notice, these crosses are situated in the main direction of the black spots. We will explain the figures a little more fully. In the first place we have here the first, and up to the present the only, practical figure that is known to us regarding budded clearings in Java; it was communicated by Mr. Gunst at a Planters' Meeting at Rangkasbitoeng in January 1933. It concerns $22\frac{1}{2}$ ha. ($55\frac{1}{2}$ acres) of mixed budded clearings of Clones B.D. 2, B.D. 5 and B.D. 10 on Bodjong Datar Estate, which yielded in the sixth year 452 kg. per ha. (404 lb. per acre), or approximately 1·8 kg. (4·0 lb.) per tree. It must have been a great source of satisfaction to Mr. Gunst, the enthusiastic champion of buddings as planting material, to bear witness to this result.

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* In order to remove any misapprehension we must emphasise forcibly that by this method of reckoning we do not want to create the impression that we attach greater importance to yield per tree than to yield per ha. The usual figure expressed in practice is yield per ha. Since, however, the graph is based on the yields of buddings in small areas which cannot be reckoned in kg. per ha., the yields must be expressed in kg. per tree in order that the figures may be comparable.

Then we have the three practical figures, published by Heusser, from Aloer Djamboe and Batang Trap Estates on the East Coast of Sumatra. They concern in the first place a plantation of 107 ha. (267 acres) planted partly with AV 36 in monoclone and partly with AV 36 mixed with other AV clones. The yield was 378 kg. per ha. (337 lb. per acre) in the sixth year, or approximately 1·9 kg. (4·2 lb.) per tree. Then an area of 49 ha. (121 acres) of the same clearing planted with AV 36 in monoclone gave 610 kg. per ha. (543 lb. per acre) in the seventh year, or 3·5 kg. (7·7 lb.) per tree. Further, 17 ha. (42 acres) of mixed planting with various AV clones on poorer soil gave 479 kg. per ha. (427 lb. per acre) in the seventh year, i.e. 2·3 kg. (5·1 lb.) per tree.

Then you will see here a group of three practical figures of the H.A.P.M. on the East Coast of Sumatra published by Dr. s'Jacob in a lecture at Djember in December 1930, viz. 2 ha. (5½ acres) of untested H.A.P.M. clones with a yield of 1238 kg. per ha. (1103 lb. per acre), or 5.0 kg. (11.0 lb.) per tree, in the ninth year, and 1628 kg. per ha. (1450 lb. per acre), or 6·5 kg. (14·3 lb.) per tree, in the tenth year of age. Further, there is an area of 80 ha. (200 acres) of untested H.A.P.M. clones with a yield of 1121 kg. per ha. (1000 lb. per acre), or 4·7 kg. (10·3 lb.) per tree, in the tenth year.

Finally, there is yet another dependable figure referring to a budded area which in the ninth year gave a yield of 1,529 kg. per ha. (1,361 lb. per acre), which is equal to 5·7 kg. (12·5 lb.) per tree.

We do not at present know of any further yields on a practical scale, but I believe that the eight figures given above allow us to draw a far reaching conclusion.

These earliest budded clearings to be established on a practical scale are, indeed, partly planted with clones which are no longer considered to be the best, and partly with untested clones of completely different origin. Nevertheless the yields of these budded clearings come entirely within the main range of our experimental gardens, and up to, and including, the tenth year of life they completely confirm the course of production at the experimental stations.

It is impossible to overestimate the importance of this agreement. Indeed it banishes our last doubts regarding the yields of buddings planted on a practical scale. There is also

no reason to suppose that the yield of clearings on a large scale will in later years proceed any differently to the experimental gardens, and that the yields of the older clearings will not improve according to the graph. What does this mean ?

If we were to trace a line through the middle of the small crosses we arrive at yields of 1·8 kg. (4·0 lb.) per tree in the sixth year, gradually rising to 10 kg. (22 lb.) in the fifteenth year.

With our young clearings, which have been laid out according to the latest ideas, we are certainly on the safe side with these yields.

With the optimum number of trees per ha. we can therefore expect with certainty from our younger budded clearings, average yields of from 500 kg. per ha. (445 lb. per acre) in the sixth year, to 2,000 kg. per ha. (1,780 lb. per acre) in the fifteenth year of age.

In comparison with our present estates planted from unselected seed this represents a trebling to quadrupling of the yield—a great step forward.

I hope I have been able to show you that in the light of the most recently available data complete reliance can now be placed on budgrafts as planting material.

RUBBER RESEARCH SCHEME (CEYLON)

Minutes of the Seventeenth Meeting of the Board of Management, held at 11 a.m. on Tuesday, August 1, 1933, at the Grand Oriental Hotel, Colombo.

(Minutes of the Sixteenth Meeting held on July 6, 1933, were not published as the proceedings mainly related to negotiations in connection with the purchase of an estate).

Present.—Dr. J. C. Hutson (in the chair), (Acting Director of Agriculture), Mr. I. L. Cameron, Mr. C. E. A. Dias, J.P., Mr. B. F. de Silva, Mr. E. L. Fraser, Mr. H. R. Freeman, M.S.C., Mr. L. F. Gapp, Mr. F. H. Griffith, Col. T. G. Jayewardene, V.D., Mr. J. L. Kotalawala, M.S.C., Mr. F. A. Obeyesekere, M.S.C., Mr. C. A. Pereira, Mr. B. M. Selwyn, Mr. E. W. Whitelaw.

Mr. T. E. H. O'Brien, Director of Research, was present by invitation, and acted as Secretary to the meeting.

Letters of apology for absence were received from Messrs. C. W. Bickmore, C.C.S., Deputy Financial Secretary and E. C. Villiers, M.S.C.

MINUTES

Minutes of the meeting held on July 6, 1933, were confirmed and signed by the Chairman.

ACCOUNTS

Statement of receipts and payments of the Board for the quarter ended June 30, 1933, was considered. The Chairman pointed out that the income from cess collections for the six months was considerably in excess of the estimate, amounting to Rs. 82,682/- compared with a total estimate for the year of Rs. 105,350/-. The statement of accounts was adopted.

Experiment Station accounts for June, 1933 were tabled.

DEVELOPMENT OF THE RESEARCH SCHEME

The Chairman reported that an advertisement for a mature rubber estate had been issued in the local press as decided at the last meeting. One reply had been received, offering an estate of 102 acres which had previously been under consideration. The Estate Committee had inspected this estate and also the estate which had been offered to the Board at the last meeting. The Committee's report had been circulated to members and it would be for the Board to reach a decision on the matter.

After a full discussion regarding the area of land required for experiments, the funds available for development, and the relative suitability of the two properties it was decided that Dartonfield Estate (173 acres : situated at Agalawatte) be purchased for experimental purposes. An amendment that the other estate be purchased and a further amendment that a a decision be deferred, had previously been put to the meeting. A supplementary estimate for the funds required for the purchase of the estate and incidental expenses was approved. The Chairman was authorised to make the necessary arrangements for the conveyance of the property and to take possession of the estate when the necessary formalities were completed. Mr. B. F. de Silva was nominated to authenticate the seal of the Board on the documents, together with the Chairman.

A Committee consisting of Messrs C. E. A. Dias, L. P. Gapp, F. H. Griffith, Col. T. G. Jayewardene and Mr. E. W. Whitelaw with Mr. T. E. H. O'Brien as Secretary was appointed temporarily to deal with matters relating to the working of the estate.

The question of the acquisition of Crown land in the vicinity of the estate was considered and the Committee was instructed to make a recommendation to the Board at the next meeting.

RUBBER RESEARCH SCHEME (CEYLON)

LIST OF PUBLICATIONS FOR SALE.

Bulletins at Re. 1-00 per copy.

No. 1. The Effect of Tapping on the Movements of Plant-Food in Hevea brasiliensis.
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No. 3. Seasonal Variations in the Movements of Plant-Food in Hevea brasiliensis Part I.
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